

EF Flash Bulletin

1,4-Dioxane: Reducing Upward Bias in Sampling Results

Issue: 1,4-dioxane is present in a wide range of soaps and detergents as a byproduct of ethoxylation during their manufacture. [ATSDR 2012] Detergents are commonly used in the field and laboratories during the sampling and analysis of environmental samples. If care is not taken to thoroughly rinse off residues of these soaps and detergents, cross-contamination can cause upward bias in 1,4-dioxane data.

Background: Detergents are used in leak detection testing for well systems, and to clean re-usable sampling equipment and laboratory glassware. During groundwater sampling for a remedial investigation at a Superfund Alternative Site in Pennsylvania, 1,4-dioxane was unexpectedly detected in four wells in which multi-port well systems were installed. A thorough investigation of the potential sources of the 1,4-dioxane revealed that it most likely came from residue left behind in the well from detergent used in leak detection testing done during construction of the multi-port well systems. This investigation identified the potential for detergents containing 1,4-dioxane to impact groundwater sampling and analysis results.

Potential actions: The potential for cross-contamination or biased results can be avoided with some simple additional steps, such as those suggested below. Consider possible cross-contamination issues when developing field sampling plans and quality assurance project plans.

Problem: Techniques for testing groundwater monitoring wells and sampling equipment for leaks often use detergents that may contain 1,4-dioxane.

Solution: Avoid leak detection techniques relying on materials containing 1,4-dioxane. Any detergents used in leak detection should first be analyzed and shown not to contain significant levels of 1,4-dioxane.

Problem: If re-usable sampling equipment (e.g., tubing, connectors, pumps, sample containers) is insufficiently rinsed during decontamination, 1,4-dioxane from detergent residue can cause upward bias in subsequent sampling results.

Solution: When sampling for 1,4-dioxane, collect additional and/or more frequent field and equipment blanks during sampling to detect any contaminants from residual detergent left behind on sampling equipment.

Problem: If laboratory glassware is insufficiently rinsed during decontamination, 1,4-dioxane from detergent residue can cause upward bias in subsequent analytical results.

Solution: When analyzing in the lab for 1,4-dioxane (1) any detergents used to wash glassware and equipment should first be analyzed and shown not to contain significant levels of 1,4-dioxane; (2) carefully rinse laboratory glassware and other re-usable analytical equipment; and (3) collect additional and/or more frequent equipment blanks during analysis to detect any contaminants from residual soap or detergent left behind on glassware equipment.

Key Message

Care should be taken to avoid upward bias in sampling results for 1,4-dioxane resulting from residues left behind on sampling equipment from leak testing or decontamination.

Commented [GG1]: Does this issue potentially cast doubt on 1,4-dioxane detections at some sites? If yes, would it be appropriate/useful to tactfully suggest that detections up to XX ppb may warrant some closer inspection of field blanks or lab blanks? Or is this bulletin enough? DAVE C & DAVE B: WHAT DO YOU THINK?

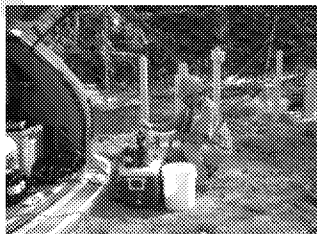


Figure [SEQ Figure 1* ARABIC]
Groundwater sampling

Commented [LFiedler2]: Is there specific EPA guidance on developing field sampling plans and QAPPs that we should cite and add to resources section?

About Engineering Forum Flash Bulletins

The Engineering Forum (EF) is a group of EPA regional, laboratory, and headquarters engineers and other technical support staff that support the Superfund and RCRA programs in each of the 10 EPA regional offices. The group was organized to exchange up-to-date engineering and scientific information related to remediation, and promote consistent cleanups.

EF Flash Bulletins are intended as an internal communications tool to alert regional cleanup program management, project managers and technical staff to urgent engineering, technical or technology issues. The bulletins highlight key findings and lessons learned identified through in-house technical support activities or forwarded by site teams in the regions.

If you have questions or would like to offer a topic for future bulletins, please contact Kira Lynch at [[HYPERLINK](#)

Supporting Resources

Technical Fact Sheet 1,4-dioxane:

[[HYPERLINK "http://www2.epa.gov/fedfac/technical-fact-sheet-14-dioxane"](http://www2.epa.gov/fedfac/technical-fact-sheet-14-dioxane)] (8pp, 136KB) (EPA505-F-14-011 Jan 2014)

This fact sheet, developed by the EPA Federal Facilities Restoration and Reuse Office (FFRRO), provides a summary of the contaminant 1,4-dioxane, including physical and chemical properties; environmental and health impacts; existing federal and state guidelines; detection and treatment methods; and additional sources of information.

Toxicological Profile for 1,4-Dioxane:

[[HYPERLINK "http://www.atsdr.cdc.gov/toxprofiles/tp187.pdf"](http://www.atsdr.cdc.gov/toxprofiles/tp187.pdf)] (7.9MB, ATSDR, 2012)

This ATSDR toxicological profile succinctly characterizes the toxicologic and adverse health effects information for 1,4-dioxane.

Groundwater Sampling Guidelines for Superfund and RCRA Project Managers:

http://www.epa.gov/superfund/remedytech/tp/download/gw_sampling_guide.pdf (53 pp, 631 KB) (OSWER EPA 542-S-02-001 May 2002)

This document provides a summary of recommended groundwater sampling procedures for a variety of chemicals including VOCs.

OSHA chemical sampling information for 1,4-dioxane:

[[HYPERLINK "https://www.osha.gov/dts/chemicalsampling/data/CH_237200.html"](https://www.osha.gov/dts/chemicalsampling/data/CH_237200.html)] (OSHA, 2013)

This link from the US Occupational Safety and Health Administration (OSHA) provides exposure limits, health factors, and monitoring methods for dioxane.

Method 8260B: Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS):

[[HYPERLINK "http://www.epa.gov/osw/hazard/testmethods/sw846/pdfs/8260b.pdf"](http://www.epa.gov/osw/hazard/testmethods/sw846/pdfs/8260b.pdf)] (EPA, 1996)

Method 8260B SIM with heated purge and trap and isotope dilution is currently the most accurate and precise laboratory method for analyzing for 1,4-dioxane in groundwater.

Additional information on 1,4-dioxane can be found at: [[HYPERLINK](#)

["http://www.cluin.org/contaminantfocus/default.focus/sec/1,4-Dioxane/cat/Overview"](http://www.cluin.org/contaminantfocus/default.focus/sec/1,4-Dioxane/cat/Overview)]

Planned Follow-up Activities

None

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